

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) An optical pickup apparatus [for reproducing information from an optical information recording medium or for recording information onto an optical information recording medium], comprising:

a first light source for emitting a first light flux having a first wavelength for reproducing or recording information from or onto a first optical information recording medium having a first transparent substrate and a first information recording plane, the first transparent substrate having a first thickness;

a second light source for emitting second light flux having a second wavelength for reproducing or recording information from or onto a second optical information recording medium having a second transparent substrate and a second information recording plane, the second transparent substrate having a second thickness, the first wavelength being different from the second wavelength, and the first thickness being different from the second thickness;

a converging optical system having an optical axis [and], a first diffractive portion, and a second diffractive portion farther from the optical axis than the first diffractive portion;

a photo detector for receiving light flux reflected from the first information recording plane or the second information recording plane;

wherein in case that the first light flux passes through the first diffractive portion to generate at least one diffracted ray, an amount of first n-th ordered diffracted ray of

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the first light flux is great than that of any other ordered diffracted ray of the first light flux, and in case that the second light flux passes through the first diffractive portion to generate at least one diffracted ray, an amount of the second n-th ordered diffracted ray of the second light flux is great than that of any other ordered diffracted ray of the second light flux, where n stands for one an integer other than zero;

wherein the converging optical system converges the first n-th ordered diffracted ray of the first light flux which passes through the first diffractive portion and a diffracted ray of the first light flux which passes through the second diffractive portion on the first information recording plane of the first optical information recording medium through the first transparent substrate so as to reproduce or record information from or onto the first optical information recording medium; and

wherein the converging optical system converges the second n-th ordered diffracted ray of the second light flux which passes through the first diffractive portion on the second information recording plane of the second optical information recording medium through the second transparent substrate so as to reproduce or record information from or onto the second optical information recording medium.

2-6. (Cancelled).

7. (Currently Amended) The optical pickup apparatus of claim [[5]]1, wherein the following formula is satisfied:

$$\lambda_1 \text{ [[>]] } \leq \lambda_2 \text{ and } t_1 < t_2$$

wherein λ_1 is the wave length of the first light flux,

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λ_2 is the wave length of the second light flux,

t_1 is the thickness of the first transparent substrate, and

t_2 is the thickness of the second transparent substrate.

8. (Currently Amended) The optical pickup apparatus of claim 7, wherein the converging optical system comprises an objective lens and the following formula is satisfied:

$$NA > NA_2$$

Where wherein NA_1 is a predetermined numerical aperture of the first optical information recording medium for the first light flux at an image side of the objective lens, and NA_2 is a predetermined numerical aperture of the second optical information recording medium for the second light flux at an image side of the objective lens.

9. (Currently Amended) The optical pickup apparatus of claim 8, wherein ~~the n -th ordered diffracted ray is a positive first ordered diffracted ray~~ n is +1.

10. (Original) The optical pickup apparatus of claim 8, wherein the following formula is satisfied:

$$0.55 \text{ mm} < t_1 < 0.65 \text{ mm}$$

$$1.1 \text{ mm} < t_2 < 1.3 \text{ mm}$$

$$630 \text{ nm} < \lambda_1 < 670 \text{ nm}$$

$$760 \text{ nm} < \lambda_2 < 820 \text{ nm}$$

$$0.55 < NA_1 < 0.68$$

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$$0.40 < NA2 < 0.55$$

11-12. (Cancelled).

13. (Original) The optical pickup apparatus of claim 10, wherein t_1 is 0.6 mm, t_2 is 1.2 mm, λ_1 is 650 nm, λ_2 is 780 nm, NA1 is 0.6 and NA2 is 0.45.

14. (Currently Amended) The optical pickup apparatus of claim 8, wherein the ~~conversion~~ converging optical system comprises an objective lens, and the objective lens has a first diffractive portion and a second diffractive portion, and wherein in case that the converging optical system converges the second n-th ordered diffracted ray of the second light flux which passes through the first diffractive portion on the second information recording plane of the second optical information recording medium, ~~the a~~ spherical aberration comprises a discontinuing section ~~by~~ in at least one place.

15. (Original) The optical pickup apparatus of claim 14, wherein the spherical aberration comprises the discontinuing section at a place near NA2.

16-18. (Cancelled).

19. (Currently Amended) The optical pickup apparatus of claim 8, wherein the ~~conversion~~ converging optical system comprises an objective lens, ~~and~~ the objective lens has a first diffractive portion, and in case that the converging optical system

converges the n-th ordered diffracted ray of the second light flux having passed over the diffractive portion on the second information recording plane of the second optical information recording medium in order to conduct the recording or the reproducing for the second optical information recording medium, ~~the~~ a spherical aberration is continued without having a discontinuing section.

20-24. (Cancelled).

25. (Original) The optical pickup apparatus of claim 1, wherein a difference in wavelength between the first light flux and the second light flux is 80 nm to 400 nm.

26. (Currently Amended) The optical pickup apparatus of claim 1, wherein the first diffractive portion and the second diffractive portion ~~comprises~~ comprise a plurality of annular bands formed coaxially around the optical axis or centered around a point near the optical axis ~~as center~~.

27-49. (Cancelled).

50. (Currently Amended) The optical pickup apparatus of claim 1, wherein ~~the n-th ordered diffracted ray is a positive first ordered diffracted ray or a negative first ordered diffracted ray~~ n is +1 or -1.

51-61. (Cancelled).

62. (Original) The optical pickup apparatus of claim 1, wherein the converging optical system comprises a objective lens, and wherein the first light flux of non-parallel light flux is allowed to go into the objective lens when the first light flux is used, and the second light flux of non-parallel light flux is allowed to go into the objective lens when the second light flux is used.

63-64. (Cancelled).

65. (Original) The optical pickup apparatus of claim 1, wherein the converging optical system comprises a objective lens, and wherein the first light flux of parallel light flux is allowed to go into the objective lens when the first light flux is used and the second light flux of non-parallel light flux is allowed to go into the objective lens when the second light flux is used, or the first light flux of non-parallel light flux is allowed to go into the objective lens when the first light flux is used and the second light flux of parallel light flux is allowed to go into the objective lens when the second light flux is used.

66-67. (Cancelled).

68. (Currently Amended) The optical pickup apparatus of claim 1, wherein the converging optical system comprises an objective lens, and wherein the first light flux of parallel light flux is allowed to go into the objective lens when the first light flux is used

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and the second light flux of parallel light flux is allowed to go into the objective lens when the second light flux is used.

69-75. (Cancelled).

76. (Original) The optical pickup apparatus of claim 1, wherein over shoot is 0% to 20%.

77. (Currently Amended) An ~~optical element~~ objective lens for use in an optical pickup apparatus for reproducing or recording information from or onto an optical information recording medium ~~or for recording information onto an optical information recording medium~~, the objective lens comprising:

an optical axis[.]; and

a first diffractive portion and a second diffractive portion farther from the optical axis than the first diffractive portion,

wherein in case that a first light flux having a first wavelength for reproducing or recording information from or onto a first optical information recording medium having a first transparent substrate passes through the first diffractive portion to generate at least one diffractive ray, an amount of first n-th ordered diffracted ray of the first light flux is greater than that of any other ordered diffracted ray of the first light flux, and in case that ~~the a second light flux whose wavelength is different from that of the first light flux~~ having a second wavelength for reproducing or recording information from or onto a second optical information recording medium having a second transparent substrate

passes through the diffractive portion to generate at least one diffracted ray, an amount of second n-th ordered diffracted ray of the second light flux is greater than that of any other ordered diffracted ray of the second light flux, the first wavelength being different from the second wavelength, wherein a difference in wavelength between the first light flux and the second light flux is being 80 nm to 400 nm, and the thickness of the first transparent substrate being different from the thickness of the second transparent substrate, where and n stands for one an integer other than zero, so that the objective lens converges the first n-th ordered diffracted ray of the first light flux which passes through the first diffractive portion and a diffracted ray of the first light flux which passes through the second diffractive portion on a first information recording plane of the first optical information recording medium through the first transparent substrate so as to reproduce or record information from or onto the first optical information recording medium, and the objective lens converges the second n-th ordered diffracted ray of the second light flux which passes through the first diffractive portion on a second information recording plane of the second optical information recording medium through the second transparent substrate so as to reproduce or recording information from or onto the second optical information medium.

78-83. (Cancelled).

84. (Currently Amended) The ~~optical element of claim 82~~ objective lens of claim 77, wherein the following formula is satisfied:

$$\lambda_1 < \lambda_2 \text{ and } t_1 < t_2$$

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where λ_1 is the wave length of the first light flux,

λ_2 is the wave length of the second light flux,

t_1 is the thickness of the first transparent substrate, and

t_2 is the thickness of the second transparent substrate.

85. (Currently Amended) The ~~optical element~~ objective lens of claim 84, wherein the following formula is satisfied:

$$NA_1 > NA_2$$

Where wherein NA_1 is a predetermined numerical; aperture of the first optical information recording medium for the first light flux at an image side of the objective lens, and NA_2 is a predetermined numerical aperture of the second optical information recording medium for the second light flux at an image side of the objective lens.

86. (Currently Amended) The ~~optical element~~ objective lens of claim 85, wherein ~~the n-th ordered diffracted ray is a positive first ordered diffracted ray~~ n is +1.

87. (Currently Amended) The ~~optical element~~ objective lens of claim 85, wherein the following formula is satisfied:

$$0.55 \text{ mm} < t_1 < 0.65 \text{ mm}$$

$$1.1 \text{ mm} < t_2 < 1.3 \text{ mm}$$

$$630 \text{ nm} < \lambda_1 < 670 \text{ nm}$$

$$760 \text{ nm} < \lambda_2 < 820 \text{ nm}$$

$$0.55 < NA_1 < 0.68$$

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$$0.40 < NA2 < 0.55.$$

88-89. (Cancelled).

90. (Currently Amended) The ~~optical element~~ objective lens of claim 87, wherein t_1 is 0.6 mm, t_2 is 1.2 mm, λ_1 is 650 nm, λ_2 is 780 nm, NA1 is 0.6 and NA2 is 0.45.

91. (Currently Amended) The ~~optical element~~ objective lens of claim 85, wherein the optical element is an objective lens, and in case that the objective lens converges the second n-th ordered diffracted ray of the second light flux, which passes through the first diffractive portion on the second information recording plane of the second optical information recording medium, ~~the~~ a spherical aberration comprises a discontinuing section in at least one place.

92. (Currently Amended) The ~~optical element~~ objective lens of claim 91, wherein the spherical aberration comprises the discontinuing section at a place near NA2.

93-95. (Cancelled).

96. (Currently Amended) The ~~optical element~~ objective lens of claim 85, wherein ~~the optical element is an objective lens, and in case that the converging optical~~

~~system~~ objective lens converges the second n-th ordered diffracted ray ~~in~~ of the second light flux having passed over the first diffractive portion on the second information recording plane of the second optical information recording medium in order to conduct the recording or the reproducing for the second optical information recording medium, ~~the~~ a spherical aberration is continued without having a discontinuing section.

98-101. (Cancelled).

102. (Currently Amended) The ~~optical element~~ objective lens of claim 77, wherein the first diffractive portion and the second diffractive portion ~~comprises~~ comprise a plurality of annular bands formed coaxially around the optical axis or around a center point near the optical axis ~~as center~~.

103-112. (Cancelled).

113. (Currently Amended) The ~~optical element~~ objective lens of claim 102, wherein the first diffractive portion and the second diffractive portion ~~are~~ is provided on ~~the~~ substantially the entire ~~surface of a light flux-incoming surface or~~ substantially the entire a light flux-outgoing surface of the ~~optical element~~ objective lens.

114. (Currently Amended) The ~~optical element~~ objective lens of claim 102, wherein ~~an area of the diffractive portion is 10% to 90% of an area of a light flux~~

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~~incoming surface or a light flux outgoing surface of the optical element~~ the first
diffractive portion and the second diffractive portion are provided on a part of a light flux-
incoming surface or a light flux-outgoing surface of the objective lens.

115-127. (Cancelled).

128. (Currently Amended) The optical element objective lens of claim 77,
wherein the ~~n-th ordered diffracted ray is a positive first ordered diffracted ray or a~~
~~negative first ordered diffracted ray~~ n is +1 or -1.

129-133. (Cancelled).

134. (Original) The optical pickup apparatus of claim 77, wherein over shoot is
0% to 20%.

135. (Currently Amended) An apparatus for reproducing or recording
information from or onto an optical information recording medium ~~or for recording~~
~~information onto an optical information recording medium,~~ the apparatus comprising;
an optical pickup apparatus, comprising
a first light source for emitting a first light flux having a first wavelength for
reproducing or recording information from or onto a first optical information recording
medium having a first transparent substrate and a first information recording plane, the
first transparent substrate having a first thickness;

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a second light source for emitting second light flux having a second wavelength for reproducing or recording information from or onto a second optical information recording medium having a second transparent substrate and a second information recording plane, the second transparent substrate having a second thickness, the first wavelength being different from the second wavelength, and the first thickness being different from the second thickness;

a converging optical system having an optical axis, ~~and~~ a first diffractive portion, and a second diffractive portion farther from the optical axis than the first diffractive portion; and

a photo detector for receiving light flux reflected from the first information recording plane or the second information recording plane;

wherein in case that the first light flux passes through the first diffractive portion to generate at least one diffracted ray, an amount of first n-th ordered diffracted ray of the first light flux is greater than that of any other ordered diffracted ray of the first light flux, and in case that the second light flux passes through the first diffractive portion to generate at least one diffracted ray, an amount of second n-th ordered diffracted ray of the second light flux, where n stands for one ~~an~~ integer other than zero,

wherein the converging optical system converges the first n-th ordered diffracted ray of the first light flux which passes through the first diffractive portion and a diffracted ray of the first light flux which passes through the second diffractive portion on the first information recording plane of the first optical information recording medium through the first transparent substrate so as to reproduce or record information from or onto the first optical information recording medium, and

wherein the converging optical system converges the second n-th ordered diffracted ray of the second light flux which passes through the first diffractive portion on the second information recording plane of the second optical information recording medium through the second transparent substrate so as to reproduce or record information from or onto the second optical information recording medium.

136. (Currently Amended) A method of reproducing information for or recording information on at least two kinds of optical information recording media by an optical pickup apparatus comprising a first light source, a second light source, a photo detector and a converging optical system having an optical axis, a first diffractive portion and a second diffractive portion located farther from the optical axis more than the first diffractive portion, the method comprising the steps of[[,:]]:

emitting a first light flux from the first light source or a second light flux from the second light flux, wherein a wavelength of the second light flux is different from a wavelength of the first light flux;

letting the first light or the second light flux pass through the first diffractive portion to generate at least one diffractive ray of the first light flux or a least one diffracted ray of the second light flux, wherein when an amount of first n-th ordered diffracted ray among the at least diffracted ray of the first light flux is greater than an amount of any other ordered diffracted ray of the first light flux, an amount of second n-th ordered diffracted ray among the at least one diffracted ray of the second light flux is greater than an amount of any other ordered diffracted ray of the second light flux[[,:]];
and

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converging, by the converging optical system, the first n-th ordered diffracted ray of the first light flux which passes through the first diffractive portion and a diffracted ray of the first light flux which passes through the second diffractive portion onto a first information recording plane of a first optical information recording medium through the first transparent substrate so as to reproduce or record information from or onto the first optical information recording medium, or converging, by the converging optical system, the second n-th ordered diffracted ray of the second light flux which passes through the first diffractive portion onto a second information recording plane of a second optical information recording medium through the second transparent substrate so as to reproduce or record information from or onto the second optical information recording medium, the thickness of the first transparent substrate being different from the thickness of the second transparent substrate; and in order for the optical pickup apparatus to record the information onto or reproduce the information from the first information recording plane or the second information recording plane

detecting, by a photo detector, a first reflected light flux of the converged n-th ordered diffracted light from the first information recording plane or a second reflected light flux of the converged n-th ordered diffracted light from the second information recording plane[;].

where wherein n stands for one an integer other than zero.

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